

**PATENT**

**Applicant:** Liu

**Serial No.:** 10/061,830

**Filing Date:** 01/31/02

**Title:** Fuel Cell With Fuel Droplet  
Fuel Supply

**Group Art Unit:** 1745

**Examiner:** Yuan

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BOARD OF PATENT APPEALS AND INTERFERENCES**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**Mail Stop Appeal Brief - Patents**

**SECOND SUPPLEMENTAL REPLY BRIEF**

Sir:

In response to the Second Supplemental Examiner's Answer dated July 13, 2007, please enter and consider the following.

## I. INTERPRETATION OF CLAIMS UNDER 35 U.S.C. § 112, SIXTH PARAGRAPH

As noted by the Board of Appeals and Interferences (the "Board") in the Remand to the Examiner dated October 27, 2006, means-plus-function elements must be interpreted in accordance with 35 U.S.C. § 112, sixth paragraph. Along these lines, the MPEP requires a **two-part analysis** of means-plus-function elements. **First**, "the application of a prior art reference to a means or step plus function limitation **requires** that the prior art element **perform the identical function** specified in the claim." [MPEP § 2182, emphasis added.] **Second**, "**if a prior art reference teaches identity of function** to that specified in a claim, **then** under *Donaldson* an examiner carries the initial burden of proof for showing that the prior art structure or step is the same as or equivalent to the structure, material, or acts described in the specification which has been identified as corresponding to the claimed means or step plus function." [Id., emphasis added.]

The Final Office Action dated March 17, 2005, the January 13, 2006 Examiner's Answer, and the December 7, 2006 Supplemental Examiner's Answer ("the First Supplemental Examiner's Answer") each failed to (1) properly consider the respective functional statements in the means-plus-function elements recited in claims 8 and 20, and (2) properly determine what the corresponding structures actually are. In response to the Order Returning Undocketed Appeal to Examiner dated May 31, 2007, the Examiner made the following assertion with respect to the means-plus-function element in claim 8:

With respect to claim 8, the recitation "fuel supply means" is understood as a fuel supply apparatus that includes a manifold (146) and a fan (148) in addition to a thermal drop ejector (128). The thermal drop ejector, the manifold and the fan together perform the function of supplying a plurality of droplets to the fuel passage between an anode pair according to the admission by the Appellants in page 3 of the Supplemental Reply Brief filed February 1, 2007.

[Second Supplemental Examiner's Answer at page 6.] The Examiner also made a similar statement concerning the means-plus-function element in claim 20. Applicant respectfully submits that there are a variety of errors associated with these statements.

Most notably, instead of doing a full means-plus-function analysis, the “corresponding structure” discussion in the Second Supplemental Examiner’s Answer consisted of nothing more than a reference to portions of the fuel supply apparatus 118a illustrated in FIG. 4, i.e. the thermal drop ejector 128, manifold 146 and a fan 148. Once again, the Examiner did not even begin to address the six (6) other examples of structure for performing the claimed function described in the specification, i.e. the fuel supply apparatus 118 (FIG. 1), the fuel supply apparatus 118b (FIG. 7), the fuel supply apparatus 118c (FIG. 8), the fuel supply apparatus 118d (FIG. 9), the fuel supply apparatus 118e (FIGS. 13 and 18) and the fuel supply apparatus 118f (FIG. 19). The fuel supply apparatus 118 and 118b-f, **some of which include a fan and some of which do not**, are discussed in Section V-E (pages 3-4) of the Appeal Brief.

The above-quoted statement also mentioned an “admission by the Appellants” concerning the function performed by the thermal drop ejector 128, manifold 146 and a fan 148. To the extent that this statement was intended to indicate that the fuel supply apparatus 118 and 118b-f do not perform the claimed function, the statement is erroneous and is hereby traversed.

Applicant hereby requests that, in lieu of ordering the Examiner to prepare a Third Supplemental Examiner’s Answer, the Board simply adopt the means-plus-function analysis presented in the Appeal Brief.

## II. THE OBJECTION AND REJECTION UNDER 35 U.S.C. §§ 132 AND 112

Dependent claim 83 indicates that the “fuel supply apparatus” recited in claim 82 “directs a plurality of droplets into the fuel passage in a direction that is **substantially parallel** to the anode surface that receives fuel.” The Examiner objected to the amendment that added this language under 35 U.S.C. § 132 and rejected claim 83 under the first paragraph of 35 U.S.C. § 112. Applicant’s arguments concerning the objection and rejection were presented on pages 10-13 of the Appeal Brief. The Examiner’s response was presented on pages 11-12 of the First Supplemental Examiner’s Answer. Applicant’s arguments concerning the issues raised by the First

Supplemental Examiner's Answer were presented on pages 5-9 of the Supplemental Reply Brief. The issues raised by the Second Supplemental Examiner's Answer are discussed below.

**A. Claim 83 Itself**

The Examiner previously asserted that claim 83 was not supported by the application because a skilled artisan "would not be able to deduce nor infer the facts [sic] how the fuel droplets travel *in the fuel passage*" along the "*beginning, middle and end* of the travel path of the fuel droplets." [First Supplemental Examiner's Answer at pages 11-12.] Applicant previously argued these assertions were not only inaccurate, they were irrelevant because claim 83 does not specify how the fuel droplets behave along the "beginning, middle and end" of the fuel droplet travel path and, instead, claim 83 simply indicates that the fuel supply apparatus "directs a plurality of droplets into the fuel passage" in a particular direction. [Supplemental Reply Brief at page 6.] In response, the Examiner appears to have withdrawn the above-quoted assertion and has taken the position that the arrows illustrated in FIG. 1 of the present application "do not provide any support for the travel direction of the fuel droplet." [Second Supplemental Examiner's Answer at page 12.] The errors associated with this position are discussed in Section II-B below.

**B. FIG. 1 of the Present Application Clearly Illustrates Droplets Being Directed Into the Fuel Passage in a Direction Parallel to the Anode Surface**

In the context of FIG. 1, the First Supplemental Examiner's Answer indicated that "[d]ue to the schematic nature of the drawings, one of ordinary skill in the art would not be able to deduce nor infer the facts [sic] how the fuel droplets travel in the fuel passage." [Supplemental Examiner's Answer at page 12.] Applicant argued that this assertion was incorrect because:

(1) the Brief Description of the Drawings section of the application indicates that FIG. 1 (which is reproduced on the following page) is a **"diagrammatic view,"** not a "schematic" view;

(2) the word "diagrammatic" means "[a] plan, sketch, drawing, or outline designed to demonstrate or explain how something works or to clarify the relationship between the parts of a whole;" and

(3) FIG. 1 clearly demonstrates that the fuel supply apparatus 118 directs droplets into the fuel passage 114 and that the droplets are directed in a direction that is substantially parallel to the anode surface that receives fuel.

[Supplemental Reply Brief at page 7.] The Examiner responded by abandoning the "schematic" argument and simply asserting that, in his opinion, the arrows illustrated in FIG. 1 "do not provide any support for the travel direction of the fuel droplet."

[Second Supplemental Examiner's Answer at page 12.]

The Examiner did not, however, provide any basis or explanation for his opinion. In particular, the Examiner failed to explain how a diagrammatic drawing, which (1) is "designed to demonstrate or explain how something works or to clarify

the relationship between the parts of a whole" and (2) clearly shows fuel droplets being **directed into** the fuel passage in a direction that is substantially parallel to the anode surface, could have been interpreted by one of skill in the art to be illustrating something other than that which is clearly shown.

The Examiner also again asserted that FIGS. 4, 7-9, 13 and 18-19 of the present application somehow support his contention that a "fuel supply apparatus [which] directs a plurality of droplets into the fuel passage in a direction that is **substantially parallel** to the anode surface that receives fuel" was not supported by the application as filed. There are a number of errors associated with this contention. For example, even assuming for the sake of argument that the Examiner was correct about FIGS. 4, 7-9, 13 and 18-19, the claim may be supported by the other embodiments disclosed in the

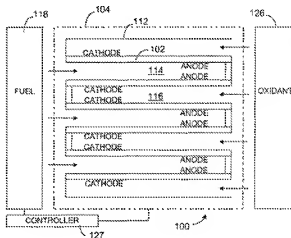


FIG. 1

application (e.g. those illustrated in FIG. 1 and/or FIGS. 13-18). [FIGS. 13-18 are discussed in Section II-C below.] The Examiner's assertion also ignores that at least some of the fuel droplets FIGS. 4, 7-9, 13 and 19 are being **directed into** the fuel passage passages in a direction that is substantially parallel to the anode surface. The claim requires nothing more.

**C. The Second Supplemental Examiner's Answer Has Again Incorrectly Characterized The Portions Of The Specification Associated With FIGS. 13-18**

The Examiner has repeatedly asserted that the fuel supply apparatus 118e illustrated in FIGS. 13-18 does not direct a plurality of droplets into the fuel passage in a direction that is **substantially parallel** to the anode surface that receives fuel. [See, e.g., First Supplemental Examiner's Answer at page 12.] Applicant has repeatedly responded to this assertion by describing, with reference to the drawings and specification, how the fuel supply apparatus 118e illustrated in FIGS. 13-18 actually operates. [See, e.g., Supplemental Reply Brief at page 8.] The Examiner, in his most recent attempt to justify the new matter objection and rejection, made the following new assertions:

Appellants further alleges in page 8 of the Supplemental Reply Brief dated February 1, 2007 that the first firing mode, which is illustrated in Figure 16 (see above), show fuel droplets ejected by the drop ejectors travel in direction that is generally perpendicular to the plate [sic] defined by the outermost portion of the nozzle. However, the instant specification does not provide any discussion whatsoever regarding the relationship between anode surface and the travel direction of the droplets. ***Droplets fired straight out of the drop ejector nozzles can travel with trajectories as shown in Figure 18 above.*** It is the position of the examiner that one of skill in the art would not recognize that droplets fired [sic] straight out of the drop ejector nozzles (186) would travel in a direction that is substantially parallel to the surface of the anode.

[Second Supplemental Examiner's Answer at page 14, emphasis added.] In other words, and as is explained in greater detail below, the Examiner misleadingly used language from the specification concerning the first firing mode (FIG. 16), which is the

firing mode that fires droplets in the direction defined by claim 83, in the context of the second firing mode (FIG. 18), which is firing mode that fires droplets in directions other than that defined by claim 83.

Given the number of iterations between the Response to the Final Rejection and this Second Supplemental Reply Brief, a brief review of the fuel supply apparatus 118e illustrated in FIGS. 13-18 would appear to be in order. Referring first to FIG. 13, which is reproduced below, the fuel supply apparatus 118e includes a plurality of flextensional drop ejectors 172. FIG. 14, which is the "plan view of a portion of a flextensional drop ejector" that is reproduced here, shows that the flextensional drop ejectors 172 include a flexible membrane 180 with nozzles 186. [Spec. at page 3, line 3; and page 9, lines 3-18.] The droplets 120 are fired through the nozzles 180. Applicant respectfully submits that one of skill in the art would readily recognize that the flextensional drop ejectors 172 face the fuel passages 114 and, more particularly, that the nozzles 186 in the membrane 180 face the fuel passages 114. The specification also indicates that "the use of flextensional drop ejectors allows fuel to be fired into the fuel passages 114 in a variety of ways." [Spec. at page 9, lines 10-12.]

Turning to FIG. 16, which is reproduced on the following page, the specification indicates that in the **first firing mode**, the fuel droplets ejected by the drop ejectors 172 "travel in a direction that is generally perpendicular to the plane defined by the outermost portion of the nozzle (i.e. straight out of the nozzle)." [Spec. at page 9, line 30 to page 10, line 1.] The specification goes on to state that the droplets are fired "straight into the fuel

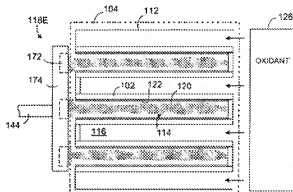


FIG. 13

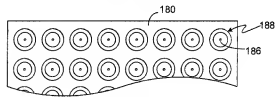


FIG. 14

passages 114.” [Spec. at page 10, lines 1-3.] To summarize, and referring to FIGS. 13, 14 and 16, the specification indicates that in the **first firing mode** the droplets 120 travel (1) “generally

perpendicular to the outermost portion of the nozzle [186]”, “straight out of the nozzle [186]” and (3) “straight into the fuel passages 114.” Given that the only reasonable interpretation of FIGS. 13 and 14 is that the nozzles 180 face the fuel passages 114, one of skill in the art would recognize that a droplet exiting a nozzle in the manner described here being directed into the fuel passage in a direction that is **substantially parallel** to the anode surface.

Turning to FIGS. 17 and 18, which are reproduced below, the droplets are **not** fired in a direction that is substantially parallel to the anode surface in the **second firing mode**. Instead, the drop ejectors 172 “fire fuel droplets toward the surface of each anode 106 in the manner illustrated for example in FIG. 18.” [Spec. at page 10, lines 11-13.] Were one of skill in the art to read the portion of the specification which describes what is shown in FIGS. 17 and 18, i.e. page 10, lines 4-18, the skilled artisan would notice that the **specification does not state that the droplets are being fired “straight out of the nozzle [186]” or that the droplets are being fired “straight into the fuel passages 114.”**

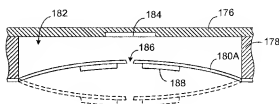


FIG. 16

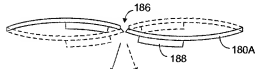


FIG. 17

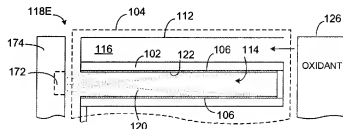


FIG. 18

Returning to the newly presented assertions of the Examiner quoted on page 6 of this Brief, i.e. that one of skill in the art would interpret FIG. 18 as illustrating the firing of droplets “straight out of the drop ejector nozzles” and that firing in this manner is not



"substantially parallel to the surface of the anode," applicant respectfully submits one of skill in the art who had reviewed the specification would understand that the Examiner's assertions are entirely incorrect. The only reference to droplets being fired "straight out of the drop ejector nozzles" is that which occurs in the context of FIG. 16, i.e. **the first firing mode**. FIGS. 1, 13, 14 and 16 clearly show, and the specification clearly describes, droplets being fired into the fuel passage 114 in a direction that is **substantially parallel** to the anode surface in the first firing mode. The mere fact that FIGS. 17 and 18 show that droplets may be fired in another direction in the second firing mode is irrelevant.

#### **D. Conclusion**

As discussed in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, "a fuel supply apparatus [that] directs a plurality of fuel droplets into the fuel passage in a direction that is substantially parallel to the anode surface that receives fuel" was clearly illustrated and described in a manner that satisfies the requirements of 35 U.S.C. §§ 112 and 132. The rejection and objection under 35 U.S.C. §§ 112 and 132 are, therefore, improper and should be reversed.

### **III. THE REJECTION UNDER 35 U.S.C. § 102**

The Office Action rejected claims 1-3, 7, 8, 11-15, 17, 20, 82, 84, 85 and 89 under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,440,594 to Kindler ("the Kindler '594 patent"). Applicant's arguments concerning the rejection under 35 U.S.C. § 102 were presented on pages 13-24 of the Appeal Brief. The Examiner's response was presented on pages 12-16 of the Supplemental Examiner's Answer. The issues by the First Supplemental Examiner's Answer were discussed on pages 9-15 of the Supplemental Reply Brief. The Examiner's response thereto was presented on pages 14-26 of the Second Supplemental Examiner's Answer. The issues raised by the Second Supplemental Examiner's Answer are discussed below.

### A. Claims 1-3 and 7

As discussed in detail on pages 16-18 of the Appeal Brief and pages 9-10 of the Reply Brief, the Kindler '594 patent does not anticipate independent claim 1 because, for example, it does not teach or suggest a fuel cell system that has both "a fuel cell stack including **a plurality of anodes**" and "**a single fuel supply apparatus** that supplies a plurality of fuel droplets to **each of the anodes**." To the contrary, the Kindler '594 patent discloses one system in which a **single** aerosol generator 21 (with atomizers 25) supplies fuel droplets to a **single** anode 14 (see FIG. 1), an alternative version of the system illustrated in FIG. 1 in which a **single** aerosol generator 321 that supplies fuel droplets to a **single** anode of a single membrane electrode assembly 314 (see FIG. 3), and a system in which a **plurality of in situ** aerosol generators (with atomizers 612) respectively supply fuel to a **plurality of anodes** 602 (see FIG. 6). The Second Supplemental Examiner's Answer responded as follows:

It appears that Appellants purposely misrepresent the teaching of Kindler reference, which contradicts with [sic] their arguments. The passage quoted by the Appellants is duplicated as follows (Kindler, Column 15, Line 63 to Column 16, Line 2).

FIG 6. illustrates a preferred aerosol generator comprising a plurality of individual in situ atomizers, each atomizer 612 situated at the internal surface of the anode biplate 602 so as to atomize liquid fuel droplets into the anode chamber 618 (emphasis added).

As discussed above, Kindler never discloses the use of multiple aerosol generators in the system. On the contrary, Kindler repeatedly teaches the use of a single aerosol generator for the entire fuel cell system, e.g., component 21 in Figure 1 (see above) and component 321 in Figure 3 (see below). Unequivocally, Kindler references disclose a fuel cell stack including a plurality of anodes and a single fuel supply apparatus, i.e., the aerosol generator, that supplies a plurality of fuel droplets to each of the anode (anode biplate 602) as recited in claim 1 of the present invention.

[Second Supplemental Examiner's Answer at pages 15-16.] Applicant respectfully submits that it is the Examiner, not the Appellant, who is attempting to mislead the Board.

To that end, and referring to FIG. 6 (reproduced below), the Kindler '594 patent states that "[a] preferred aerosol feed fuel cell configuration in which **membrane electrode assemblies are stacked** to obtain uniform fuel delivery is shown in FIG. 6." [Column 15, lines 57-59.] The Kindler patent also indicates that:

The fuel cell 600 is formed by joining an anode biplate 602 and a cathode biplate 604. The membrane electrode assembly 608 is formed by joining an anode assembly 602 and a cathode assembly 606 to opposite surfaces of the interposed membrane 604. Each anode biplate 602 has an internal surface comprising a flowfield element 610 and an aerosol generator.

[Column 15, lines 61-63.] In other words, from a big picture standpoint, this portion of the Kindler '594 patent is describing a typical fuel cell stack wherein a plurality of membrane electrode assemblies 608 are stacked one after another with the anodes 602 and cathodes 606 of adjacent membrane electrode assemblies 608 adjacent one another, but for the two ends of the stack.<sup>1</sup> With respect to the more specific issue of providing fuel to the anodes in the stack of membrane electrode assemblies 608, the Kindler '594 patent indicates that "[e]ach **anode biplate 602 has** an internal surface comprising a flowfield element 610 and **an aerosol generator.**" In view of the forgoing, one of skill in the art would understand that (1) fuel cell 600 consists of a stacked plurality of membrane electrode assemblies 608, (2) that each membrane electrode assembly 608 includes an anode 602 ("assembly" or "biplate"), a membrane 604 and a cathode 606, and (3) each anode 602 has its own aerosol generator.

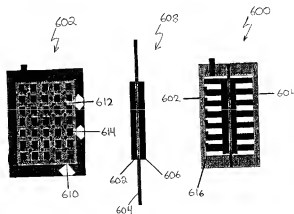


FIG. 6

<sup>1</sup> The anodes 602 and cathodes 606 are alternately referred to as biplates, e.g. "anode biplate," and assemblies, e.g. "cathode assembly." The use of the word "biplate" may be related to the fact that, in some types of fuel cell stacks, adjacent anodes and cathodes are separated by a bipolar plate. The bipolar plates separate fuel from oxygen, while electrically connecting adjacent membrane electrode assemblies. The Kindler anode and cathode assemblies appear to be configured to perform the bipolar plate function.

Next, the Kindler '594 patent describes the aerosol generators, which is one of the things that **each** of the anodes 602 has in the stack 600 of membrane electrode assemblies 608 illustrated in FIG. 6. In particular, the Kindler '594 patent states that:

FIG. 6 illustrates **a preferred aerosol generator comprising a plurality of individual in situ atomizers**, each atomizer 612 situated at the **internal surface of the anode biplate 602** so as to atomize liquid fuel droplets into the anode chamber 616.

[Column 15, line 66 to column 16, line 2, emphasis added.] By using the Latin phrase "**in situ**" and indicating the each atomizer is "situated at the **internal surface** of the anode biplate 602," the Kindler '594 patent re-emphasizes that atomizers 612, which make up the aerosol generator, are part of the anode 602.

Turning to the Examiner's references to "component 21" in FIG.1 and "component 321" in FIG. 3, the Second Supplemental Examiner's Answer suffers from essentially the same defect as the First Supplemental Examiner's Answer, i.e. the Examiner appears to have again attempted to impermissibly mix and match the elements of the systems illustrated in FIG. 1 and/or FIG. 3 with the elements of the system illustrated in FIG. 6. Such mixing and matching, absent an explicit teaching to do so, is impermissible in a rejection under 35 U.S.C. § 102.<sup>2</sup>

It should also be noted for the record that the system illustrated in FIG. 3 suffers from the same defect as that illustrated in FIG. 1. In particular, the system illustrated in FIG. 3 includes a **single** aerosol generator 321 that supplies fuel droplets to a **single** anode of a single membrane electrode assembly 314, as is noted above.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler '594 patent fails to teach or suggest each and every element of the combination recited in independent claim 1 and that the rejection of claims 1-3 and 7 under 35 U.S.C. § 102 should be reversed.

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<sup>2</sup> To anticipate, every element and limitation of the claimed invention must be found in a single prior reference, arranged as in the claim. *Karsten Manufacturing Corp. v. Cleveland Golf Co.*, 58 USPQ2d 1286 (Fed. Cir. 2001), citing *C.R. Bard, Inc. v. M3 Systems, Inc.*, 48 USPQ2d 1225, 1229-30 (Fed. Cir. 1998).

## B. Claims 8 and 11-13

As discussed in detail on pages 18-20 of the Appeal Brief and pages 6-8 of the Reply Brief, the Kindler '594 patent does not anticipate independent claims 8 and 11 because it does not teach or suggest, for example, ***an anode pair with anodes that face one another and define a fuel passage therebetween*** in combination with a fuel supply apparatus that supplies (or "means for supplying") a plurality of droplets to the fuel passage between the anode pair.

The First Supplemental Examiner's Answer responded to applicant's arguments by baselessly asserting that one of skill in the art would have recognized that "the anode biplate in Figure 6 [of the Kindler '594 patent] is defined as two parallel anodes facing each other to define a fuel passage between the anode surfaces." [First Supplemental Examiner's Answer at page 14.] Applicant attempted to explain to the Examiner that (1) the use of term "biplate" appeared to be a typographical error because the Kindler '594 patent used two different phrases to refer to the same element, i.e. "anode assembly 602" and "anode biplate 602," and applicant was unable to find other uses of the phrase "anode biplate" despite an extensive electronic database search<sup>3</sup> and (2) the ***typographical error issue notwithstanding***, the above-quoted assertion concerning "biplates" is clearly contradicted by the express teachings of the Kindler '594 patent.

The Second Supplemental Examiner's Answer responded with the following collection of erroneous assertions:

Again, Kindler reference discusses the fuel cell (600) is formed by joining an anode biplate (602) and a cathode biplate (604) as shown above. The membrane electrode assembly (608) is formed by joining an anode assembly (biplate) and cathode assembly (604) to opposite surfaces of the interposed membrane. Kindler further teaches schematic representation of an aerosol fuel cell being transported in the anode biplate. Figure 4 below shows the case of low power density operation, in which liquid droplets (432) travel between two opposing porous anode backing materials (436) to the catalyst layer (438). Similarly, liquid droplets (532) travel between two opposing anode backing materials (536) are

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<sup>3</sup> See also footnote 1 for one possible explanation.

shown in Figure 5, in which higher rate of droplet coalescence occurs before the fuel droplets reach the catalyst layer (538). See Column 13, Line 46 to Column 14, Line 29.

It can be drawn from the disclosure above that the term "anode assembly" and "anode biplate" are interchangeable because both terms define an anode chamber in which fuel droplets pass through before they reach the catalyst surface. The "anode biplate" in the Kindler reference therefore can be labeled as "anode pair" as recited in claims 8 and 11 because both have anodes that face one another with a fuel passage therebetween.

[Second Supplemental Examiner's Answer at pages 17-18.] The errors associated with the Examiner's assertions are discussed below in the order in which they occur.

First, the assertion that "Figure 4 below shows ... liquid droplets (432) [traveling] between two opposing porous anode backing materials (436) to the catalyst layer (438)" is categorically false. Referring to column 3, lines 20-23, the Kindler '594 patent indicates that:

FIG. 4 provides a schematic representation of an aerosol fuel feed being transported by diffusion within **a pore having a diameter** defined by the walls of **a** backing structure adhered to **a** catalyst layer to form **an** electrode.

[Emphasis added.] Applicant respectfully submits that one of skill in the art would understand that what is shown in FIG. 4 of the Kindler '594 patent, which is reproduced on the below, is a section-like schematic view of a cylindrical (or similarly shaped) pore that is associated with a single anode that extends in a direction perpendicular to fuel travel, not two planar anodes (or anode backing materials) facing one another. Interestingly, the extensive discussion in Second Supplemental Examiner's Answer failed to mention reference numeral 434, despite the fact that the Kindler '594 patent specifically describes the corresponding element as "an **individual pore 434** of **the** porous anode backing material 436." [Column 13, lines 46-50.]

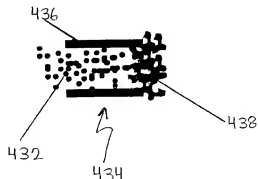


FIG. 4

Moving along, the assertion that “liquid droplets (532) travel between two opposing anode backing materials (536) are shown in Figure 5 ... before the fuel droplets reach the catalyst layer (538)” is also false. Referring to column 3, lines 24-28, the Kindler '594 patent indicates that:

FIG. 5 provides a schematic representation of an aerosol fuel feed being transported by diffusion and capillary wicking ***within a pore*** defined by the walls of a hydrophilic backing structure adhered to a catalyst layer to form an electrode.

[Emphasis added.] Applicant respectfully submits that one of skill in the art would understand that what is shown in FIG. 5 of the Kindler '594 patent, which is reproduced below, is a section-like schematic view of a cylindrical (or similarly shaped) pore that is associated with a single anode that extends in a direction perpendicular to fuel travel, not two planar anodes (or anode backing materials) facing one another. Interestingly, the extensive discussion in Second Supplemental Examiner's Answer failed to mention reference numeral 534, despite the fact that the Kindler '594 patent specifically describes the corresponding element as “an ***individual pore 534*** of the porous anode backing material 536.” [Column 14, lines 14-16.]

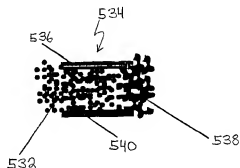


FIG. 5

Next, according to the Examiner's “logic,” one of skill in the art would understand that because an “anode assembly” (or “anode bipole”) has a chamber, it “can be labeled as ‘anode pair’ as recited in claims 8 and 11 because both have anodes that face one another with a fuel passage therebetween.” Applicant respectfully submits that the mere presence of a chamber does not necessarily lead to the conclusion that there are anodes on opposite sides of the chamber. To the contrary, and as described in detail above, the Kindler '594 patent makes it perfectly clear that this is not the case.

It should also be noted that the Second Supplemental Examiner's Answer, like the First Supplemental Examiner's Answer, failed to provide any evidence whatsoever - no

issued patent, no published application, no journal article, no technical dictionary definition - in support of the assertion that a skilled artisan would define an "anode biplate" as two spaced parallel anodes with a fuel passage therebetween.

The Second Supplemental Examiner's Answer also failed to address, let alone rebut, the arguments concerning the express teachings of the present application and the Kindler '594 patent that were presented on page 12 of the Supplemental Reply Brief.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler '594 patent fails to teach or suggest each and every element of the respective combinations recited in independent claims 8 and 11 and that the rejection of claims 8 and 11-13 under 35 U.S.C. § 102 should be reversed.

### C. Claims 14, 15 and 17

As discussed in detail on pages 20-21 of the Appeal Brief, pages 8-9 of the Reply Brief and page 13 of the Supplemental Reply Brief, the Kindler '594 patent does not anticipate independent claim 14 because it does not disclose, for example, the step of "directing a spray of fuel droplets into **a fuel passage that extends from a first anode in an anode pair to a second anode in the anode pair** such that at least some of the droplets come to rest on the first anode and at least some of the droplets come to rest on the second anode."

In response, the Examiner made the following assertion on page 19 of the Second Supplemental Examiner's Answer:

As discussed in details above, the anode biplate is defined by two opposing porous anodes (436 in Figure 4 and 536 in Figure 5) with a fuel passage therebetween. Figures 4 and 5 of Kindler visibly show some of the droplets come to rest on first anode surface and some the droplets come to rest on second anode surface.

In other words, the Examiner appears to be taking the position that two diametrically opposed surfaces of the **an individual pore 434 (or 534) in a single porous anode** are first and second anode surfaces. [Note the discussion of the individual pores in the



preceding section of this Second Supplemental Reply Brief.] The impropriety of this position notwithstanding, the Examiner's opinion concerning two surfaces of the **same pore in a single anode** has no bearing whatsoever on a claim which calls for, *inter alia*, the step of "directing a spray of fuel droplets into a fuel passage that extends from a **first anode in an anode pair** to a **second anode in the anode pair**." There is simply no reasonable interpretation of "a first anode in an anode pair" and "a second anode in the anode pair" that would read on two surfaces of a single pore in a single anode.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler '594 patent fails to teach or suggest each and every element of the combination recited in independent claim 14 and that the rejection of claims 14, 15 and 17 under 35 U.S.C. § 102 should be reversed.

#### D. Claim 20

As discussed in detail on pages 21-22 of the Appeal Brief, pages 9-10 of the Reply Brief and page 14 of the Supplemental Reply Brief, the Kindler '594 patent does not anticipate independent claim 20 because the Kindler '594 patent fails to teach or suggest, for example, "a **controller** adapted to monitor a rate of fuel consumption at the anode and to **control the fuel supply means to supply droplets at a rate that results in a fuel layer being maintained** on the anode."

The Second Supplemental Examiner's Answer did not respond to the arguments presented in the Supplemental Reply Brief and, instead, merely repeated verbatim the assertions made on pages 15-16 of the First Supplemental Examiner's Answer. [Second Supplemental Examiner's Answer at pages 19-20.] As noted in prior briefs, even assuming *arguendo* that both of the Examiner's assertions are accurate, they do not necessarily lead to the conclusion that the Kindler '594 patent teaches or suggests maintaining a fuel layer on the anode, as would be required for a rejection under 35 U.S.C. § 102. To the contrary, these assertions appear to suggest **preventing** a fuel layer from being maintained on the anodes.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler '594 patent fails to teach or suggest each and every element of the combination recited in independent claim 20 and that the rejection of claim 20 under 35 U.S.C. § 102 should be reversed.

**E. Claims 82, 84, 85 and 89**

As discussed in detail on pages 22-24 of the Appeal Brief, pages 10-11 of the Reply Brief and pages 14-15 of the Supplemental Reply Brief, the Kindler '594 patent does not anticipate independent claim 82 because it does not disclose, for example, "a fuel supply apparatus that ***directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode surface that receives fuel.***" To the contrary, the Kindler aerosol generators clearly direct droplets in a direction that is perpendicular to the anode surface. [Note, for example, FIG. 1.]

The Second Supplemental Examiner's Answer did not respond to the arguments presented in the Supplemental Reply Brief and, instead, merely repeated verbatim the assertions made on page 16 of the First Supplemental Examiner's Answer. [Second Supplemental Examiner's Answer at page 20.]

As noted in previous Briefs, the Examiner's assertions concerning Brownian motion and the manner in which droplets enter the pores illustrated in FIGS. 4 and 5 of the Kindler '594 patent are irrelevant because claim 82 specifies the direction in which droplets are ***directed into*** a fuel passage by the fuel supply apparatus, as opposed to the direction at which each individual droplet is moving at any particular time after being directed into a fuel passage. More importantly, the assertions did nothing to change the fact that the Kindler '594 patent fails to even remotely suggest that the aerosol generators disclosed therein direct droplets in any direction other than perpendicular to the anode surface.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler '594 patent fails to teach or suggest each and every

element of the combination recited in independent claim 82 and that the rejection of claims 82, 84, 85 and 89 under 35 U.S.C. § 102 should be reversed.

#### **IV. THE REJECTION UNDER 35 U.S.C. § 103 BASED ON THE KINDLER '594 PATENT**

The Office Action rejected claims 4-6 and 86-88 under 35 U.S.C. § 103 as being unpatentable over the Kindler '594 patent. Applicant's arguments concerning the rejection under 35 U.S.C. § 103 were presented on pages 25-26 and 28-29 of the Appeal Brief. The Examiner's response was presented on pages 17-18 and 19-20 of the First Supplemental Examiner's Answer. The issues raised by the First Supplemental Examiner's Answer were discussed on pages 15-17 of the Supplemental Reply Brief. The Examiner's response thereto was presented on pages 20-22 of the Second Supplemental Examiner's Answer. The issues raised by the Second Supplemental Examiner's Answer are discussed below.

##### **A. Claims 4-6**

As discussed in detail on pages 25-26 of the Appeal Brief, pages 11-12 of the Reply Brief and pages 15-16 of the Supplemental Reply Brief, the Kindler '594 patent does not render claims 4-6 obvious because, for example, it does not teach or suggest a "fuel cell" in combination with a "thermal drop ejector" (claim 4), a "piezoelectric drop ejector" (claim 5), or a "flexensional drop ejector" (claim 6). Instead, the Kindler '594 patent discloses "fuel cells" in combination with a "boiling/cooling" drop generator and a variety of atomizing drop generators, and nothing in the Kindler '594 patent itself even remotely suggests that "thermal," "piezoelectric" and/or "flexensional" drop ejectors could be used in place of the Kindler "boiling/cooling" and atomizing drop generators.

Faced with this clear deficiency in the Kindler '594 patent, the Examiner opined that "thermal," "piezoelectric" and "flexensional" drop ejectors are the functional and/or mechanical equivalents of the "boiling/cooling" and atomizing drop generators disclosed in the Kindler '594 patent and, accordingly, that it would have been obvious to substitute

"thermal," "piezoelectric" and "flexensional" drop ejectors for the "boiling/cooling" and atomizing drop generators disclosed in the Kindler '594 patent. Applicant responded by noting that the Examiner's position is in clear conflict with MPEP § 2144.06. In particular, the Examiner has failed to provide any evidence whatsoever - no issued patent, no published application, no journal article, no technical dictionary definition - which shows that the purported equivalency between "boiling/cooling" and atomizing drop generators and the claimed "thermal," "piezoelectric" and "flexensional" drop ejectors **was recognized in the art**. Moreover, the mere fact that two components are functionally and mechanically equivalent is not, in and of itself, sufficient to establish a *prima facie* case of obviousness.

The Second Supplemental Examiner's Answer responded to these arguments with yet another collection of erroneous assertions:

Appellants further dispute in the Supplemental Reply Brief dated February 1, 2007 (page 16) that examiner fails to provide any concrete evidence that shows the alleged equivalency. First, it has come to realize that the different ejectors recited in claims 4 through 6 are not widely recognized in the patent literature, let alone in the fuel cell art. Using the USPTO search tool EAST, the term "flexensional drop ejector" only appears once when all the database, including PGPUB, USPAT, EPO, JPO and DERWENT, are searched. Not surprisingly, the term is only cited in the instant specification. The term "thermal drop ejector" is found in two patent literatures while "piezoelectric drop ejector" is found in eight. Examiner does not believe that issued patents, published applications or journal articles would be required to show the proposed equivalency. Nevertheless, the functional and mechanical equivalency between the ejectors disclosed by Kindler and the present disclosure is established based on the limited description and technical information available in the instant disclosure. As discussed above, rationale and reasoning to substitute equivalents known for the same purpose are carefully presented. The court upheld an express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982).

[Second Supplemental Examiner's Answer at page 22.] The errors associated with the Examiner's assertions are discussed below in the order in which they occur.

The Examiner asserted that "it [sic] has come to realize that the different ejectors recited in claims 4 through 6 are not widely recognized in the patent literature, let alone

in the fuel cell art ..." This statement, if true, would tend to show that the claimed combinations are **non-obvious** under Section 103. The undersigned thanks the Examiner for this helpful observation.

The Examiner also asserted that he "does not believe that issued patents, published applications or journal articles would be required to show the proposed equivalency." The MPEP does not share the Examiner's belief. To that end, MPEP § 2144.06 states that "[i]n order to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be **recognized in the prior art**, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents." Citations omitted, emphasis added. To date, the Examiner has failed to produce a scintilla of evidence, e.g. a patent or a journal article, concerning art-recognized equivalence.<sup>4</sup> Quite to the contrary, the Examiner asserted in the Second Supplemental Examiner's Answer that the "ejectors recited in claims 4 through 6 are not widely recognized ... in the fuel cell art."

Next, the Examiner indicated that "the functional and mechanical equivalency between the ejectors disclosed by Kindler and the present disclosure is established based on the limited description and technical information available in the instant disclosure." The Examiner's opinion that the claimed drop ejectors are functionally and mechanically equivalent to those disclosed in the Kindler '594 patent has no bearing whatsoever on the issue of obvious. Again, "the equivalency must be recognized in the prior art, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents." MPEP § 2144.06, citations omitted.

Finally, the Examiner cited *In re Fout*, 213 USPQ 532 (CCPA 1982), for the proposition that an "express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious." While this

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<sup>4</sup> To the extent that the Examiner has taken "official notice" with respect to knowledge generally available in the art, applicant traversed in the Feb. 12, 2004 amendment and requested an affidavit in accordance with MPEP § 2144.03 and 37 C.F.R. § 1.104(d)(2). To date, no such affidavit has been provided by the Examiner.

may be true, what is necessary for an “obvious” substitution is “equivalency [that is] recognized in the prior art.” MPEP § 2144.06, citations omitted. The Examiner failed to make the necessary showing.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and the preceding portion of this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler ‘594 patent fails to render the inventions defined by claims 4-6 obvious and that the rejection of claims 4-6 under 35 U.S.C. § 103 should be reversed.

## **B. Claims 86-88**

As discussed in detail on pages 28-29 of the Appeal Brief, pages 12-13 of the Reply Brief and page 17 of the Supplemental Reply Brief, the Kindler ‘594 patent does not render claims 86-88 obvious because, for example, it does not teach or suggest a “fuel cell” in combination with a “thermal drop ejector” (claim 86), a “piezoelectric drop ejector” (claim 87), or a “flectensional drop ejector” (claim 88). Instead, the Kindler ‘594 patent discloses “fuel cells” in combination with a “boiling/cooling” drop generator and a variety of atomizing drop generators, and nothing in the Kindler ‘594 patent suggests that “thermal,” “piezoelectric” and/or “flectensional” drop ejectors could be used in place of the Kindler “boiling/cooling” and atomizing drop generators.

As discussed above and in prior briefs, the unsupported assertion that “thermal,” “piezoelectric” and “flectensional” drop ejectors are the functional and/or mechanical equivalents of the Kindler “boiling/cooling” and atomizing drop generators does not establish a *prima facie* case of obviousness, and the Examiner has failed to provide any evidence whatsoever which shows the purported equivalency was **recognized in the art**. See MPEP § 2144.06.

The Second Supplemental Examiner’s Answer responded to these arguments with yet another collection of erroneous assertions:

Appellants further dispute in the Supplemental Reply Brief dated February 1,2007 (page 17) that the mere fact that **two** components are functionally and mechanically equivalent is not, in and of itself, sufficient to establish a

*prima facie* case of obviousness. In fact, the instant specification discloses the following findings

Another type of fuel drop ejector that may form part of an implementation of a present inventions is a piezoelectric fuel drop ejector and piezoelectric drop ejectors may be used in place of thermal drop ejector(s) in any of the embodiments illustrated in FIGS. 4-8. (emphasis added) (page 8 of instant disclosure)

Turning to FIGS. 13-15, a fuel cell system (such as the fuel cell system 100 illustrated in FIG. 1) may be provided with a fuel supply apparatus 118e that produces droplets with a flextensional drop ejector and flextensional drop ejectors may be used in place of thermal drop ejector(s) in any of the embodiments illustrated in FIGS. 4-8. (emphasis added) (page 9 of instant disclosure)

As admitted by the Appellants above, thermal drop ejector, piezoelectric drop ejector and flextensional drop ejector are deemed as functional and mechanical equivalencies because they are used interchangeably to produce and discharge fuel droplets into the fuel passage. The court has upheld that an applicant's expressed recognition of an art-recognized or obvious equivalent may be used to refute an argument that such equivalency does not exist. *In re Scott*, 323 F.2d 1016, 139 USPQ 297 (CCPA 1963).

[Second Supplemental Examiner's Answer at page 25.] The errors associated with the Examiner's assertions are discussed below in the order in which they occur.

For example, and although the issue is not particularly relevant, applicant has not admitted that "thermal," "piezoelectric" and/or "flextensional" drop ejectors are the functional and/or mechanical equivalents of each other. The relevant issue is, on the other hand, whether or not applicant has admitted that "thermal," "piezoelectric" and/or "flextensional" drop ejectors are the **art-recognized** functional and/or mechanical equivalents of something known in the art, e.g. the drop ejectors disclosed in the Kindler '594 patent. Applicant has not made any admissions whatsoever concerning the art-recognized functional and/or mechanical equivalents of the "thermal," "piezoelectric" and/or "flextensional" drop ejectors.

The Examiner also cited *In re Scott*, 139 USPQ 297 (CCPA 1963), for the proposition that "an applicant's expressed recognition of an art-recognized or obvious equivalent may be used to refute an argument that such equivalency does not exist." It would appear that the Examiner does not understand what is meant by "applicant's expressed recognition" and "art-recognized." "[A]pplicant's expressed recognition" is a

"statement by applicant concerning something that is recognized" and "art-recognized" means "known to those of ordinary skill in the art." Applicant has not stated that the "thermal," "piezoelectric" and/or "flextensional" drop ejectors are the equivalents of anything, let alone the drop ejectors disclosed in the Kindler '594 patent. Nor has applicant stated that the "thermal," "piezoelectric" and/or "flextensional" drop ejectors were known to those of skill in the art to be the equivalents of anything, let alone the drop ejectors disclosed in the Kindler '594 patent. Nor has applicant stated that the "thermal," "piezoelectric" and/or "flextensional" drop ejectors are obvious over anything, let alone the drop ejectors disclosed in the Kindler '594 patent.

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler '594 patent fails to render the inventions defined by claims 86-88 obvious and that the rejection of claims 86-88 under 35 U.S.C. § 103 should be reversed.

#### **V. THE REJECTION UNDER 35 U.S.C. § 103 BASED ON THE KINDLER '594 PATENT AND THE PUN '382 PATENT**

The Office Action rejected claim 16 under 35 U.S.C. § 103 as being unpatentable over the combined teachings of the Kindler '594 patent and U.S. Patent No. 6,152,382 to Pun ("the Pun '382 patent"). Applicant's arguments concerning the rejection under 35 U.S.C. § 103 were presented on pages 27-28 of the Appeal Brief. The Examiner's response was presented on pages 18-19 of the First Supplemental Examiner's Answer. The relevant issues raised by the First Supplemental Examiner's Answer were discussed on pages 17-20 of the Supplemental Reply Brief and are reiterated below. The Second Supplemental Examiner's Answer did not respond to the arguments presented in the Supplemental Reply Brief and, instead, merely repeated verbatim the assertions made on page 16 of the First Supplemental Examiner's Answer. [Second Supplemental Examiner's Answer at page 23.]

Briefly, and as discussed in detail on pages 27-28 of the Appeal Brief, the Kindler '594 and Pun '382 patents does not render claim 16 obvious because the Pun '382 patent,



which is directed to “a spray apparatus that produces uniform sized atomized droplets controllable **from fog size to larger** for spraying fungicides, bactericides, pesticides, insecticides, plant nutrients and other materials **applied to crop, ground, and foliage for agricultural and horticultural benefaction**,” would not have motivated one of skill in the art to add a fan to one of the fuel cell devices disclosed in the Kindler ‘594 patent.

With respect to the Examiner’s failure to establish a *prima facie* case of obviousness, the Examiner has not shown that there is any objective teaching to make the proposed combination.

The Examiner has also not **identified a common problem** that one of skill in the art would associate with both the generation of electricity with fuel cells and the production of “atomized droplets controllable **from fog size to larger** for spraying fungicides, bactericides, pesticides, insecticides, plant nutrients and other materials applied to crop, ground, and foliage for agricultural and horticultural benefaction” that would have supported the proposed combination. *See, e.g., Ruiz v. A.B. Chance Co.*, 69 USPQ2d 1686, 1691 (Fed. Cir. 2004).

With respect to the analogous art issue, the Examiner failed to show that a person of ordinary skill, seeking to solve a problem of supplying fuel to fuel cells, would reasonably be expected or motivated to look to apparatus that are used for “spraying fungicides, bactericides, pesticides, insecticides, plant nutrients and other materials applied to crop, ground, and foliage.” [See MPEP § 2141.01(a)-IV.]

Accordingly, for the reasons presented in the Appeal Brief, the Reply Brief, the Supplemental Reply Brief and this Second Supplemental Reply Brief, applicant respectfully submits that the Kindler ‘594 patent fails to render the invention defined by claim 16 obvious and that the rejection of claim s 16 under 35 U.S.C. § 103 should be reversed.

## VI. CLOSING REMARKS

As applicant has shown in the Appeal Brief and this Supplemental Reply Brief, the objection under 35 U.S.C. § 132 and rejection of claim 83 under 35 U.S.C. § 112 are

improper and should be reversed, the rejection of claims 1-3, 7, 8, 11-15, 17, 20, 82, 84, 85 and 89 under 35 U.S.C. § 102 is improper and should be reversed, and the rejections of claims 4-6, 9, 16 and 86-88 under 35 U.S.C. § 103 are improper and should be reversed.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 08-2025. Should such fees be associated with an extension of time, applicant respectfully requests that this paper be considered a petition therefor.

Respectfully submitted,

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Date

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